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IN-HOUSE R&D IN NATIONAL DEFENSE

Keynote Address by

Honorable John S. Foster, Jr.
Director of Defense Research and Engineering

at the

Thirteenth Annual Air Force Science and Engineering Symposium
Arnold Engineering Development Center, Tennessee

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Introduction

I am happy to have the opportunity to address this gathering of Air Force technical people—and particularly the in-house laboratory people here today.

This test center, representing an investment of almost $400 million, is a tribute to the foresight and wisdom of the Air Force in its approach to capitalizing on science and technology for the advancement of its military mission. Immediately after World War II, the Air Force, recognizing the need to take a long-range look ahead, turned to a group of outstanding scientists and engineers under the leadership of Dr. Theodore Von Karman. This group recognized that future problems in weapon-system development would require facilities such as the Air Force has built here. This recognition has stood the test of time. Since the first test in support of the operational system development of the Falcon air-to-air missile in 1952, every major weapon system developed by the Air Force, including aircraft, ballistic missiles and space systems, has depended to a major degree on the experimental facilities located here.

The Arnold Engineering Development Center has, in the main, met the overriding test that must be applied to all Air Force RDT&E activities —the test of clear and indisputable relevance to Air Force military responsibilities and objectives. It is this test and not the degree of sophistication of the science and technology that goes into attaining this result which, in the final analysis, must determine the validity of any new Air Force activity.

Turning from the past to the future, I want to discuss this morning some of the problems that face the Air Force. In particular, the Air Force's in-house facilities can—and, I believe, should—become more involved in the mainstream problems and activities of the Air Force. I have a strong conviction that competent laboratory personnel must be acutely aware of important military needs and must create new system concepts to meet them; and they must structure the Air Force's technological programs to provide an ample base for quick and workable reactions to new military needs. One way to drive home this point of deeper involvement is to describe some of the vital R&D problems that the Air Force has today—typical problems that must be understood by each of you so that your potential contributions may become real ones.

Finally, I would like to describe to you some activities that are currently under way to improve the productivity of all the Service laboratories. This effort is in the formative state; nevertheless, I mention it now to indicate to you that both the Secretary of Defense and I are anxious to have the Air Force laboratories play a more effective role in the solution of important and timely Air Force problems.

The Challenges

To begin, then, let me describe some of the challenges that I believe should be the concern of every Air Force scientist and engineer. We have two main challenges facing us today:

(1) The maintenance of an "assured-destruction" capability.
(2) The war in Southeast Asia.

The Air Force has performed a superb job in providing and maintaining the assured-destruction capability, which is vital to our national security. This capability is currently manifested in the bomber fleet and the Titan and Minuteman missile systems. The challenge is to maintain a capability for assured destruction throughout the foreseeable future, despite the efforts of other nations to deny it to us. The maintenance of our deterrent rests on three major activities:

First: Extensive research and development programs in all aspects of strategic offensive and defensive weapon systems. This effort is essential to provide the United States with at least several years' lead in the relevant technologies and to minimize the likelihood that a technological surprise will be generated by one of our adversaries.

Second: A thorough examination of the information relevant to a description of threats to U.S. security.

Third: The selection of the most efficient system concepts, designed and deployed at the force levels necessary to provide the United States with an assured-destruction capability.

In the execution of these three tasks, I believe the Air Force's in-house laboratories have a major role to play in both the first and the second activities and in part of the third.

In Vietnam, the Air Force and the Navy are doing a superb job of supporting ground forces, interdicting supply lines and striking military targets in North Vietnam. However, considering the inherent capabilities of our technology, it is reasonable to ask whether Air Force research and development have been all that they should have been since World War II. It is reasonable to ask whether B-52s and F-4Cs and F-105s are the most effective weapon systems for some of the operations they are undertaking. The war in Vietnam—and particularly the Air Force's war in Vietnam—is not peculiar. It is not a freak, one-of-a-kind affair. It is a conventional war, similar in many respects to World War II and Korea. Much as it is to be desired, such wars do not vanish. The aggressor is still free to pick the scale and vintage of war, and we find it necessary to fight it on his grounds. It is, in fact, a simple, straightforward, conventional war, and the Air Force

research and development program since World War II has not been completely responsive to the needs of this kind of war.

The Southeast Asian conflict has highlighted a number of problems of tactical warfare. Targets are much smaller and much more difficult to find than they were in World War II and Korea. Many of these targets, taken alone, are of low value compared to U.S. standards of World War II, but by enemy standards they are of high value and are therefore important to us in the war out there. We have improved much, particularly in the last couple of years, and we will continue to improve.

Now let us look at some of the continuing problems:

. Aircraft can be shot down with guns. Our aircraft today are no less vulnerable to ground fire than they were 20 years ago, though they cost almost 10 times as much. The enemy is using the same type of gun. We still have to dive on the target to improve the chances of hitting it, and when we do we are shot at.

. Aircraft can also be shot down by surface-to-air missiles (SAMs). Through tactics and other countermeasures, we have found ways to generally avoid getting shot down, but we do not yet have a very good system for destroying SAMs outside their range; and, despite recent progress, we have still much more to do toward finding their location.

. Aircraft can be shot down by other aircraft. We need to improve our capability to track overland, distinguish friend from foe, and then to destroy enemy aircraft under all combat conditions.

. Aircraft are still the primary means of finding targets on the ground, yet our means of obtaining real-time reconnaissance of ground targets that move, radiate heat, or reflect or consume power still are too limited. We still cannot see well enough at night or through weather. Yet this is when the enemy targets are present in large numbers.

. Aircraft are still the primary means of killing targets beyond the range of artillery, or when there is no artillery around. We need a better operational system that will accurately hit a small target. We have made progress in spreading out the lethality of conventional ordnance, but getting it close to the target and away from our own troops continues to be a problem during broad daylight; it is even worse at night and almost impossible in unfavorable weather.

* * *

These are some of the important problems we face today and will face for many years to come. I have highlighted the problems in Vietnam because, unwelcome though it is, a shooting war provides a test of whether or not our attention was focused on the main threats and whether or not we really solved all the main problems. With hindsight, I believe we can all agree that, since World War II, we should have paid even more attention to our nonnuclear capability. The small, fleeting

targets will continue to be important—it will keep on getting dark at night, and we will still have to find and destroy such targets. These problems demand a vigorous and continuing effort by the Air Force's laboratories.

Air Force Laboratories--An Investment

Now let's take a brief look at our investment in these laboratories.

The Air Force has approximately 25 organizations (laboratories, development centers and test centers) that involve in-house activities. These organizations manage close to $1.5 billion worth of total effort, both in-house and contractual. This is a substantial fraction of the total Air Force RDT&E effort. To handle all this, the Air Force employs upward of 8,000 military and civilian professionals. The total institutional complex represents an investment of about $1 billion in property, housed in 39 million square feet of building space, on 1 million acres of land. That's some investment!

Let's face it—the investment is huge, and it has been made. The return we are all looking for must be represented by laboratory programs that will ensure that our military forces possess superior weapons, equipment, training and technology. We can get this return if the Air Force laboratories are completely integrated into the mainstream of urgent Air Force needs, if top-level planners use the laboratories for the solution of vital problems and for technical judgments, and if the Air Force's needs and requirements direct and pace the technical programs.

Integration directed toward important objectives is paramount. As in the familiar song, "Them Bones," if the science ain't connected to the technology, and the technology ain't connected to the system development, and the system ain't connected to the reality of combat, then there ain't a strong dynamic skeleton--just a pile of bones.

There are some questions I frequently ask myself, and I hope you will ask them of yourselves.

Are the Air Force laboratories carrying out the most important RDT&E missions of the Air Force?

Do you, as individuals, become directly and intimately involved in urgent military problems facing the Air Force during these times of conflict?

I believe that the Air Force laboratories have an essential role to play with respect to both strategic and tactical systems. As a matter of fact, I predict that, in the future, whenever critical R&D problems involving conventional warfare arise, the laboratories will be directly responsible for important system solutions. In order to accomplish this, the laboratories cannot retreat or be confined to the comfort of long-range basic and exploratory research, but will also need to commit themselves decisively to urgent projects in advanced and

selected engineering development. I am not suggesting that the laboratories design and build large systems like the B-52, but rather that they be responsible for important developments on small systems and subsystems.

The Air Force has done an outstanding job in developing management techniques for major weapon systems—the SPO (system/project office), the 375 regulations, and all that go with them. It is unfortunate, however, that a rigidity has crept into your organizations and procedures that results in a tendency to apply these techniques to all engineering development (and some advanced development), including small subsystems, limited-quantity items, or even one-of-a-kind installations. In many such cases, these massive management techniques are inappropriate; they can deter technical progress and waste time and money. Furthermore, it was never the intention of the designers of these tools that they always be applied in full. The Air Force must be more selective in using the powerful management tools it has developed. The laboratories need more flexibility, and they have a major role to play in the task of selecting the management tools.

I fully realize that there may be some of you who have spent your careers with the Air Force laboratories without working on the most significant military problems. Frankly, I intend to change this situation, and I believe that during the past few months much progress has been made in this direction. Let me bring you up to date.

(1) Last December, I established a Defense Science Board Task Force on In-House Laboratories to help me generate a series of action plans.

(2) In May of this year, I convened a special group which includes the Chairmen of the PSAC (President's Science Advisory Committee) Panels on Government Laboratories and Scientific Personnel and the three Services' Directors of Laboratories. This group meets with me every month to discuss important laboratory matters. I intend to continue these meetings until—

(a) I am convinced that the laboratories' involvement in military problems is sharply increased, and

(b) most of the major administrative difficulties affecting the efficiency of the laboratories are eliminated.

(3) I have asked each of the Services to establish management mechanisms for using laboratory specialists in threat studies, requirements analyses, systems concepts, and systems evaluations. I believe that having specialists contribute to our important systems efforts will help our overall planning and will provide greater objectivity in your basic and exploratory research.

(4) I have been working directly with the Assistant Secretaries (R&D) of the Departments to determine which are likely to be the key R&D problems of the next decade. I have asked each of them to consider the establishment of mission-oriented centers of sufficient size

and scope to use in-house specialists on critical military problems. The strength of this idea is the result of a mix of scientists, technologists and engineers working in one place on an important set of common problems. The complex that has been developing at Eglin Air Force Base in recent years (particularly under the pressures of the Vietnam conflict), of which a major element is the Air Force Armament Laboratory, is a step in this direction.

(5) I have been told by several sources that the in-house laboratories cannot possibly match the quality and flexibility of response of industry and nonprofit organizations. Some of the reasons given are these:

(a) It's very hard to get rid of marginal employees.

(b) It's difficult to hire competent individuals because of excessive delays.

(c) The Military Construction Program does not permit cohesive laboratory planning.

You can add others to this list of sacred cows. I assure you that these administrative problems can be solved, and we will devote a major effort to seeing that they are solved.

I have told you the direction in which we are moving and the most appropriate roles of in-house laboratories in developing superior weapon systems. I hope you now sense that you and your laboratories are needed and are receiving more attention than ever before. The problems exist; our needs are real—the challenge is yours.